OFFICIAL MEXICAN STANDARD
NOM-033-SCT2-94
"CHARACTERISTICS AND SPECIFICATIONS FOR THE CONSTRUCTION AND RECONSTRUCTION OF TANK-CONTAINERS INTENDED FOR THE MULTIMODAL TRANSPORT OF NON-REFRIGERATED, PRESSURE LIQUEFIED GASES".

1. PURPOSE

The purpose of this Official Mexican Standard is to set forth the characteristics and specifications for the construction and reconstruction of containers intended for the multimodal transport of non-refrigerated, pressure liquefied gases as well as the approval, certification and marking of said gases and the provisions related to their transport, with a view to protecting the general lines of communication and the safety of their users.

2. APPLICABILITY

This Official Mexican Standard applies compulsorily to the manufacturers of these tank-containers, to the managers of factories authorized for their reconstruction, and to the carriers involved in their handling.

The specifications of this Standard do not apply to road tank-vehicles, rail tank-wagons, non-metallic containers or intermediate bulk-containers (IBCs) or to containers intended for the transport of gases that have a capacity of 1,000 liters (1.0 m^3) or less or that are designed to withstand a maximum allowed working pressure (MAWP) below 7.13 Kg/cm^2 (101.3 psi) (7 bars) or above 40.76 kg/cm^2 (578.8 psi) (40 bars).

3. REFERENCES

To correctly apply this Standard, the following effective Official Mexican Standards must be consulted:

NOM-003-SCT2-94 SYSTEM FOR THE IDENTIFICATION OF UNITS INTENDED FOR THE TRANSPORT OF HAZARDOUS SUBSTANCES AND WASTES.

NOM-004-SCT2-93 CHARACTERISTICS OF THE LABELS FOR CONTAINERS AND PACKAGINGS INTENDED FOR THE TRANSPORT OF HAZARDOUS SUBSTANCES AND WASTES.

NOM-029-SCT-94 TECHNICAL SPECIFICATIONS FOR THE PLACARDS WHICH MUST BE DISPLAYED BY THE ROAD TANK-VEHICLES, TANK-CONTAINERS, METALLIC INTERMEDIATE BULK-CONTAINERS (IBCs), AND CONTAINERS WITH A CAPACITY GREATER THAN 500 LITERS THAT TRANSPORT HAZARDOUS MATERIALS, SUBSTANCES AND WASTES.

NOM-030-SCT2-94 SPECIFICATIONS AND CHARACTERISTICS FOR THE CONSTRUCTION AND RECONSTRUCTION OF TANK-CONTAINERS INTENDED FOR THE MULTIMODAL TRANSPORT OF REFRIGERATED LIQUEFIED GASES.

4. DEFINITIONS

For purposes of the provisions applicable to tank-containers intended for the transport of non-refrigerated, pressure gases in Class 2, we shall rely on the definitions provided in Standard NOM-030-SCT2-1994 as well as the following definitions:

Maximum allowable working pressure (MAWP).- This means the maximum permissible gage pressure, as measured in the top part of the tank when said tank is in its normal position. It may not be lower than the vapor pressure, at the design reference temperature of any product which may be loaded and carried, and at any pressure which may be used during filling or unloading.

Discharge pressure.- This means the maximum existing [sic] pressure reached inside the shell when it is discharged by pressure.

Design reference temperature.- This means the temperature at which the vapor pressure of the contents is determined for the purpose of calculating the maximum allowable working pressure (MAWP). This value is, for the various tank types, as follows:

a) Tanks with a diameter of 1.5 m as a maximum: 65EC.

b) Tanks with a diameter of over 1.5 m:

I) Without insulation or sun shield, 60EC.

II) With sun shield: 55EC.

III) With insulation; 50EC (this value is provisional[;] it is dependent on the quality of the insulation).

Mild Steel.- This means a steel with a minimum guaranteed tensile strength of 37 daN/mm² and a guaranteed minimum percentage elongation of 27.

SPECIFICATIONS AND CHARACTERISTICS

5.1 Regarding the design and construction of tank-containers intended for the transport of non-refrigerated, pressure liquefied gases.

5.1.1 The shells of these tank-containers must be made of steel suitable for shaping. For welded shells, only a material whose weldability is fully demonstrated may be used. If the manufacturing process or the materials used so require, the tanks must be subjected to a suitable thermal treatment after the welding operations. The welds must be well made and afford complete safety. The materials of the tanks must be suitable for environment in which said materials [sic] will be used. Aluminum must not be used as a manufacturing material for the tank-containers intended for land transport.

Steel must be resistant to brittle fracture and to fissuring corrosion under tensile stress at temperatures between -30EC and the design reference temperature, unless the competent authorities set forth more stringent conditions.

5.1.2 Tank-containers. Their fittings and pipings must be made with a material:

a) That is practically inalterable by the substance carried, or

b) That is efficiently passive or neutralized by the chemical reaction with that substance.

5.1.3 Gaskets, if there are any, must be made of a material not subject to attack by the contents of the tank.

5.1.4 Precautions must be taken to avoid damage owing to the galvanic corrosion resulting from the juxtaposition of dissimilar metals.

5.1.5 The tanks, including all their devices, fittings and coverings that can be expected to come into contact with the contents, must be constructed of materials that cannot be damaged by the contents nor react dangerously with them.[sic]

5.1.6 The tank-containers must be designed and constructed with supports that provide a stable base during transport and with suitable attachments for lifting and anchoring them.

5.1.7 The shells, their attachments, and their items of service and structural equipment must be designed so as to withstand, without loss of contents, at least the internal pressure exerted by the contents, plus the most severe combination of the static and dynamic stresses in normal handling and transport.

5.1.8 The tanks must be designed so as to withstand, without permanent deformation, an external pressure of at least 0.4076 kg/m² (5.78 psi) (0.4 bars) above the internal pressure. Tanks that will be subjected to a significant vacuum before being loaded or after having been discharged, must be designed so as to withstand a pressure of at least 0.917 Kg/cm² (13.02 psi) (0.9 bars) and must be tested at that pressure.

5.1.9 The minimal dynamic loads, in addition to the static loads, that must be withstood, must be based on the values of 2 gn vertically downward, 2 gn longitudinally, and 1 gn transversely, applied toward the center of gravity of the tank.

5.1.10 The tank-containers may only be transported in vehicles whose fastenings can support, when the containers carry the maximum authorized load, the forces indicated in paragraph 5.1.9.

5.1.11 Tank-containers intended for the transport of certain gases, as listed in Table 1, must have an additional protection, which may consist of an increase of thickness of the shell plate or in a higher test pressure, the increase in pressure being determined by taking into account the danger presented by the substances to be transported; or in a protective device approved by the competent authorities.

5.1.12 Thermal insulation systems must satisfy the following requirements:

5.1.12.1 If the shell of the tank-containers intended for the transport of gases has a thermal insulation, said insulation must consist of either:

a) A shield that covers no less than the upper third and no more than the upper half of the surface of the tank-container and separated from the shell by an air space of about 4 cm around, or

b) A complete cladding, of adequate thickness, made of insulating materials protected so that the cladding cannot become wet or damaged under normal transport conditions.

The protective covering is closed so as to be gas-tight, [and] must be fitted with a device that prevents any accumulating of dangerous pressure in the insulating layer in the event of inadequate gastightness in the shell or in its items of equipment or fittings.

5.1.12.2 The thermal insulation must be designed so as not to hinder access to the fittings or to the discharge devices.

5.1.12.3 Depending on the materials of construction or the methods of fabrication, a post-weld thermal treatment or a stress-reduction treatment after forming may be required.

5.2 Specifications and characteristics regarding the cross-section.

5.2.1 The tank-containers must have a circular cross-section.

5.2.2 Tank-containers intended for multimodal transport must be protected and constructed so as to withstand a test pressure of at least 1.3 times the MAWP. Table 1 indicates specific requirements for certain materials. The requirements for minimum shell plate thickness indicated in section 5.3 must also be taken into account.

5.2.3 In choosing the materials and in determining the thickness of walls, the maximum and minimum filling and working temperatures, as well as the risk of brittle fracture, must also be taken into account.

5.2.4 At the test pressure, the stress (sigma) at the point being subjected to the maximum tank-container shell stress must not exceed the material-dependent limitations indicated below:

a) In the case of metals and alloys that have a clearly defined yield point or that are characterized by a guaranteed conventional yield point Re (generally 0.2% of the residual elongation: in the case of austenitic steels, 1% of residual elongation), the stress must not exceed the lowest of the following two values: 0.75 Re or 0.50 Rm.

b) In the case of steel, the percentile fracture elongation must not be lower than 1,000/Rm, Rm being expressed in decanewtons/mm², with an absolute minimum of 20%.

5.2.5 It should be noted that the specimens used to determine the elongation at fracture must be taken transversely in the direction of rolling and be so secured that:

$$Lo = 5\ d,$$

or

$$Lo = 5{,}65 \sqrt{A}$$

where: Lo = length of specimen before the test;

d = diameter;

A = surface of specimen cross-section.

5.3 SPECIFICATIONS AND CHARACTERISTICS REGARDING THE MINIMUM THICKNESS OF SHELL PLATE.

5.3.1 The tank-containers must be constructed in accordance with the regulation for pressure vessels. The dimensions indicated in the following paragraphs take into account the existence of standard thicknesses for the [shell] plates.

5.3.2 Tank-containers with a diameter no greater than 1,80 m (6 feet) in the cylindrical portions of the shells and the ends of the containers must be at least 5 mm (3/16 in.) thick if they are made of mild steel, or have an equivalent thickness if they are made of another metal. Tank-containers with a diameter of over 1,80 m (6 feet) must be at least 6 mm (1/4 in.) thick if they are made of mild steel, or have an equivalent thickness if they are made of another metal. The cylindrical parts and the ends of all the tank-containers must be at least 4 mm (5/32 in.) thick, regardless of the material used in their construction.

5.3.3 In the case of a metal other than mild steel that has a guaranteed minimum tensile strength of 37 decanewtons/mm² and a guaranteed minimum percentage elongation of 27, the thickness equivalent to the one prescribed in the preceding paragraph, shall be determined by using the following equation:

$$e1 = \left(\frac{10eo}{\sqrt[3]{\%Rm \times A}}\right)$$

1 1

where: e1 = Required equivalent thickness of the metal being used

eo = Minimum thickness prescribed for mild steel in paragraph 5.3.2.

Rm1 = Guaranteed minimum tensile strength of the metal being used.

A1 = Guaranteed minimum percentage elongation at rupture due to pulling of the metal being used (see section 5.2.3).

5.3.3.1 The plate thickness in any part of the shell must in no case be less than indicated in section 5.3.2.

5.3.4 The plate thickness must not change suddenly at the attachment of the top portion to the cylindrical portion of the shell, and in no case shall the thickness of the plate *[missing word]* the attachment be less than the value prescribed in section 5.2.4 and, when applicable, in this paragraph.

5.4 Specifications and characteristics regarding the items of service equipment.

5.4.1 The items of service equipment (valves, fittings, safety devices, gages, etc.) must be arranged in a way that they do not run the risk of being wrenched off or damaged during transport and handling. If the connection between the framework and the shell allows relative movement of these sub-assemblies, the items of service equipment must be fastened in such a way that this movement produces no damage to the working parts. The protection of the items of service equipment must offer a degree of safety comparable to that of the shell.

5.4.2 All orifices in the shell with a diameter greater than 1.5 mm, except those that are for safety valves, the inspection openings or closed bleed holes, must be fitted with three independent shut-off devices, arranged in series, the first being an internal stop valve, the second being an external stop valve, and the third a blank flange or equivalent device.

5.4.2.1 The flow-restricting valves must be so fitted that their seating is inside the shell, or inside a welded flange if they are fitted externally. Their mounting systems must be so designed that in case of impact, they maintain their effectiveness.

5.4.2.2 The flow-restricting valves must be designed and fitted so as to close automatically when the flow rate [sic] specified by the manufacturer is reached. Connections and accessories for leading to the valves, or originating from said valves, must have the capacity for a flow greater than the measured [sic] flow for the restrictive valve.

5.4.3 In the case of filling and discharge openings, the first shut-off device must be an internal stop valve and the second must be a stop valve placed in an accessible position on each filling and/or discharge piping.

5.4.4 In the case of filling and discharge openings of tanks intended for the transport of flammable and/or toxic gases, the internal stop valve must be an instant closing safety device which closes automatically if the tank experiments an abnormal movement or is engulfed in flames. This device can also be activated by remote control.

5.4.5 The shells of tank-containers intended for the transport of liquefied gases, in addition to the filling, discharge, and pressure equalization openings, may be fitted with openings in which gages, thermometers and manometers may be fitted. The connections of these instruments must be made through nozzles or chambers that are correctly welded and not through nozzles screwed to the shell.

5.4.6 The tank-container must be fitted with an opening large enough to enable the container to be inspected internally.

5.4.7 The external fittings must be grouped together.

5.4.8 All the tank connections must display markings that clearly indicate the function of each.

5.4.9 The fine-rope [sic] stop valves must close by clockwise rotation.

5.4.10 All pipings must be made of a suitable material. The joints of the pipings must be welded. Use must not be made of non-malleable metals for the manufacturing of the valves or accessories. The bursting strength of all the pipings and all their fittings must be at least four times the MAWP to which the tank may be subjected in service by action of a pump or other device (except the pressure-relief valves), that may be subjected by some portions of the pipings at pressures higher than the MAWP. In all cases, steps must be taken to avoid that pipings be damaged by thermal expansion and contraction, jarring and vibrations.

5.4.11 The tank-containers intended for the transport of flammable gases must be capable of being electrically grounded.

5.5 Specifications and characteristics regarding the pressure-relief devices.

5.5.1 The tank-containers must be fitted with one or several pressure-relief devices of the spring type. Fragile [sic] disks not arranged in series with a pressure-relief device of the spring type shall not be permitted. The valves must open automatically at a pressure greater than the MAWP and be completely open at a pressure equal to 1.1 times the MAWP. The valves must

close, after discharge, at a pressure not less than 10% below the pressure at which discharge starts and must remain closed at all lower pressures. The pressure-relief valves must be of a type that withstands dynamic stresses, including those due to the movement of the liquid.

5.5.2 The pressure-relief devices must be designed so as to prevent the entry of foreign matter, the leakage of gas and any dangerous increase in pressure.

5.5.3 The shells of tanks intended for the transport of certain gases listed in Table 1 must have a pressure-relief device as approved in the corresponding technical standard, except in the case of tanks specially intended for the transport of a given type of material that are fitted with an approved relief valve made of materials that are compatible with the load[;] such a device must consist of a spring valve preceded by a fragile disk. In the space between the fragile disk and the valve, a manometer or other suitable gage must be mounted. This system permits the detection of any disc rupture, perforation or leakage which may cause the malfunctioning of the pressure-relief device. In this case, the fragile disc must rupture at the start-to-discharge pressure of the relief valve.

5.5.4 The safety device must only operate if there is an excessive rise in temperature, so that the tank is not subjected during transport to excessive fluctuations of pressure due to the handling operations (see, however, section 5.5.5).

5.5.5 The total delivery capacity of all pressure-relief devices, under conditions of complete fire engulfment of the tank, must be sufficient so that pressure (including accumulated pressure) in the shell is not higher than 1.1 times the MAWP. To achieve the total prescribed delivery capacity, spring-type pressure-relief devices must be used.

5.5.6 To compute the required total capacity of the pressure-reduction devices that may be considered equal to the sum of the capacities of each of these devices, either of the following equivalent formulas may be used:

a) $$Q = 5.62 \times 10^{6} \frac{FA^{0.82}}{LC} \frac{ZT}{M}$$

WHERE:

Q = minimum required discharge flow (in m,3/h) under standard conditions, temperature 15.6EC and pressure 1 atm,

A = total external surface area of the shell (in m^2);

L = latent heat of vaporization (in cal/g);

Z = compressibility factor of the vapor (in g, m, and EK);

T = absolute temperature in EK (EC + 273) at the pressure-relief condition;[sic]

M = molecular weight of vapor in g;

C = a constant dependent on the relation between the specific heats of vapor; see 5.5.7;

F = insulation factor, equal to 1 in the case of tanks without insulation and equal to

$$\frac{8u\,(650-t)}{93.5 \times 106}$$

in insulated containers, where t is the temperature in EC of the gas or vapor within the tank, when the relief device is operating.

T = thermal conductivity of the insulation at 311EK in gcal/h.m²K), which must be a function of the thickness of the insulation.

b) $$Q = 37.98 \times 10^{6} \quad \frac{Fa^{0.82}}{LC} \quad \sqrt{\frac{ZT}{M}}$$

Where:

Q = minimum required discharge flow in cubic feet per hour at a temperature of 60EF and an absolute pressure of 14.7 psi.

A = total external surface area of the shell in square feet.

L = latent heat of vaporization [in british thermal units (BTU) per pound (BTU/lb)].

Z = vapor compressibility factor in pounds, feet, and EF;

T = absolute temperature in degrees Rankin (EF + 460) under pressure-relief conditions;

M = vapor molecular weight in pounds;

C = a constant depending on the relation between the specific heats of vapor; see 5.5.7.

F = insulation factor, equal to 1 in the case of tanks without insulation and equal to

$$\frac{8U\,(1{,}200-t)}{34{,}500}$$

In the case of insulated tanks, t being the temperature in EF of vapor or gas in the tank when the relief device is operating;

U = thermal conductivity of the insulation at 100EF [in british thermal units per hour, sq. ft., and EF (BTU/h.sq.ft.EF)], which must be a function of the thickness of the insulation.

5.5.7 "C" is a constant obtained through the following equation as a function of the relation between the specific heats:

$K \frac{cp}{cv}$ (if this factor is known, take C=315);

$$C = 520 \; k \left(\frac{2}{k+1} \right)^{\frac{k+1}{k-1}}$$

k	C	k	C	k	C
1.00	315	1.26	343	1.52	366
1.02	318	1.28	345	1.54	368
1.04	320	1.30	347	1.56	369
1.06	322	1.32	349	1.58	371
1.08	324	1.34	351	1.60	372
1.10	327	1.36	352	1.62	374
1.12	329	1.38	354	1.64	376
1.14	331	1.40	356	1.66	377
1.16	333	1.42	358	1.68	379
1.18	335	1.44	359	1.70	380
1.20	337	1.46	361	2.00	400
1.22	339	1.48	363	2.20	412
1.24	341	1.50	364		

5.5.8 Any pressure-relief device must be marked, using clearly legible and indelible characters, with the pressure or temperature at which it is expected to operate and the rated free-air delivery of the device at 15EC and one bar. Capacity marked on the valves must be the rated capacity at a pressure not greater than 110% of the pressure at which the valves are set.

5.5.9 Connections to the pressure-relief devices must be of sufficient size to enable the required discharge volume to pass unrestricted to the safety device. No stop-valve may be installed between the shell and the pressure-relief devices, unless duplicate equivalent devices were installed for maintenance and unless the stop-valves connected to the operating devices are locked open or interlocked in such a way that at least one of these duplicate devices is always in operation. The vents of the pressure-relief devices, where used, must deliver the vapor or

liquid to the atmosphere so that the back-pressure *[missing word]* the relieving device is minimum.

5.5.10 Inlets of the pressure-relief valves must be positioned in the top part of the tank, as close as possible to the longitudinal and transverse center of the tank. All pressure-relief device inlets must be positioned in the vapor space of the tanks, and the devices must be arranged in such a way that the vapor escapes freely and does not impinge on the shell. Use of protective devices for deflecting the flow of vapor shall be allowed, provided that the required valve capacity is not reduced.

5.5.11 Steps shall be taken to prevent unauthorized persons from having access to the valves and to avoid damages to valves caused by tank overturning.

5.6 Specifications and characteristics regarding the gaging devices.

5.6.1 Use must not be made of level gages made of glass or gages that are in direct communication with the contents of the tank and made of easily destructible materials.

5.7 Specifications and characteristics regarding the supports, frameworks, and lifting and tie-down attachments for tank-containers.

5.7.1 The tank-containers must be designed and manufactured with a support that ensures their stability during transport. Skids, frameworks, cradles and other similar devices are considered acceptable. As regards this aspect of the design, the loads that are indicated in the section on the minimum dynamic loads (5.1.9) must also be taken into account.

5.7.1.1 For each of these loads, the following safety factors must be observed:

a) In the case of metals having a clearly defined yield point, a safety factor of 1.5 in relation to the determined yield stress, or

b) In the case of metals not having a clearly defined yield point, a safety factor of 1.5 in relation to the guaranteed proof stress of 0.2%.

5.7.2 The combined stresses of the mountings (cradles, frameworks, etc.) and of the lifting [and] tie-down attachments of the tank-containers must not cause an excessive effort to any point of the shell. All tanks must be designed with permanent lifting and tie-down attachments, and these will preferably be fitted to the tank supports, although they may be fitted to reinforcing plates affixed at the points of support of the shell.

5.7.3 In the design of supports and frameworks, due regard must be paid to the effects of environmental corrosion. In the calculations of all structural members not made of anticorrosive materials, a minimum corrosion allowance, as determined by the competent authorities, shall be considered.

5.7.4 The tank-container frameworks that must be lifted [or] secured through their corner castings must be subjected to special tests that are internationally accepted (for example, those of ISO). Generally, the use of such frameworks within an integrated system is recommended.

6.1 For each new tank-container model, the institutions authorized by the Secretariat must issue a certificate attesting that the tank-container and its fittings, as surveyed by said institutions, are suitable for the purpose for which they are intended and meet the construction and material standards set forth in this chapter as well as, where applicable, the standards for gases in Table 1. The certificate must indicate the hazardous materials or groups of hazardous materials that are allowed to be transported in the tank-container. The report on the prototype tests shall indicate the results of said tests, the gases for which transport the tank-container has been approved, and the approval number. If the tank-containers are manufactured without any change in the structural design, the approval is deemed valid for all those manufactured in accordance with said design. The approval number must consist of the distinctive sign or mark of the State in the country that granted the approval, that is to say, the distinctive sign or mark of the country in whose territory the approval was granted, and of a registration number.

6.2 Approval of the design of a tank-container must be given for at least each design and size, it being understood that this set of tests made on a container of one size may serve for smaller containers made [of] materials of the same type and thickness, using the same manufacturing technique, and with identical supports [and] with equivalent air system and other accessories.

6.3 The shell and the various items of equipment of each tank-container must be inspected and tested together and separately before being put into service (initial inspection and tests) and thereafter at maximal intervals of five years (periodic inspection and tests).

6.4 As part of the initial inspection and tests, a check of the design characteristics, an internal and external survey, and a hydraulic pressure test must be performed. If the shell and equipment have been subjected to a pressure test *[missing word],* they must together be subjected *[missing phrase]* after been assembled. All welds of the shells must be supervised in the initial test by radiography, by ultrasound or by other non-destructive method[;] these provisions shall not apply to the metal sheathing of an insulation.

6.5 The periodic inspections and tests must include an internal and external examination, and as a general rule, a pressure test. Sheathings, thermal insulations, etc., shall not be removed more than to the extent necessary to correctly assess the tank-container condition.

6.6 The initial test and the periodic pressure tests must be conducted by a technician approved by the competent authorities and at the test pressure indicated on the technical data plate of the tank-container, except in the cases in which periodic tests at lower pressures are authorized.

6.7 While under this low pressure, the tank-container must be inspected to check if it has any leaks, corrosions, dents or other signs of weakness that could make it unsafe for transport. In case any of these signs of weakness are found, the container must not be put into service or returned to service, until it has been repaired and has satisfactorily passed a new test.

6.8 Before being put into service, and thereafter midway between the inspections and the tests provided in section 6.3, the tank-containers must be subjected to the following tests and inspections:

a) A leakproofness test, where required;

b) A test of satisfactory operation of all the items of service equipment, and

c) An internal and external inspection of the tanks and their fittings, with due regard to the gases that they transport.

6.8.1 Nevertheless, the competent authorities may waive the internal inspection in the case of tanks intended for the transport of a sole gas.

6.9 When a tank-container, not including the shell proper, is damaged, it should be repaired so as to comply with these specifications. In the event that the shell is damaged, said shell must be repaired and subjected to a new test as provided in the following paragraph.

6.10 All cutting or welding operations performed on the shell of a tank-container must be approved by the competent authorities, and a hydrostatic test to a pressure at least equal to the initial test pressure must be performed.

7. Marking and certificate.

7.1 Marking

7.1.1 Any tank-container must have a rust-proof metal plate permanently attached onto the shell in a place readily accessible for inspection in accordance with Standard NOM-023-SCT2/1994.

7.1.2 The tank-container must display markings indicating the hazardous substance or residue being transported in accordance with Standard NOM-004-SCT2/1993.

7.2 Certificate.

7.2.1 Technicians approved by the competent authorities must issue certificates attesting the results of tests performed on the tank-containers.

7.2.2 This document shall include the following information:

a) Code under which the shell was constructed.

b) Material of the shell.

c) Original test pressure in Kg/cm² (psi)

d) Month and year of the most recent test, as well as the pressure at which said test was conducted.
_____month _____year _____Kg/cm²(lb/sq.in).

e) Date of the last visual inspection.

f) Seal and signature of person who performed the test(s).

g) Name of the gases for whose transport the container was approved.

7.7.3 This document must be kept until a new test or inspection is performed, and the results of the last shall govern.

8. PROVISIONS REGARDING TRANSPORT.

8.1 The following tank-containers must not be used for transport:

8.1.1 Those that are insufficiently full, making possible inside a movement of contents that may produce unacceptable hydraulic forces;

8.1.2 Those that are leaking.

8.1.3 Those that are damaged to such an extent that the integrity of the tank or its lifting or tie-down attachments may be affected, and

8.1.4 Those whose items of service equipment have not been examined and/or found to be in good operating condition;

8.2 Empty tank-containers that are not clean and gas-free must comply with the same requirements as those that are filled with the material previously transported.

8.3 During transport, the tank-containers must be adequately protected against lateral and longitudinal impact and against overturning. This protection is not necessary if the shells and items of service equipment were been built so as to withstand impact or overturning. Examples of protection against collisions[:]

a) Protection against lateral impact may consist in longitudinal bars that protect the shell on both sides at the level of the median line;

b) Protection of the tank-containers against overturning may consist of reinforcement rings or bars affixed transversely onto the framework;

c) Protection against rear impact may consist of bumpers or a framework;

d) The external fittings must be so designed or protected as to prevent the release of contents in the event of impact or overturning of the tank on its fittings.

8.4 Certain gases are chemically unstable. They must not be accepted for transport unless the necessary steps have been taken to prevent their dangerous decomposition, transformation or polymerization during transport. To this end, special precautions must be taken to ensure that the tanks do not contain substances that could promote these reactions.

8.5 The maximum mass of liquefied gas per liter of container capacity (Kg/l) must not exceed the density of the liquefied gas at 50EC multiplied by 0.95. Furthermore, the container must not be filled with liquid at 60EC.

8.5.1 During filling, the temperature of the liquefied gas must fall within the limits of the metallurgic design temperature.

8.5.3 Containers must not be filled above their authorized gross mass.

NOTES FOR TABLE 1.

Table 1 is divided into 9 columns:

Column 1:	Indicates the United Nations number assigned to the dangerous substance.
Column 2:	Indicates the name of the hazardous substance.
Column 3:	Indicates the Division to which the hazardous substance has been assigned.
Column 4:	Indicates the secondary risks assigned to the hazardous substance.
Column 5:	Marks the maximum allowed working pressure (MAWP) in bars for each of the four different types of containers: small, bare, sun-shielded, and insulated, or refers to the MAWP definition set forth in this Standard.
Column 6:	Indicates if openings below liquid level are "allowed" or "not allowed".
Column 7:	Indicates the pressure-relief requirements that may be "normal" (see paragraph 5.5.1) or requires [sic] special reference to paragraph 5.5.3.
Column 8:	Indicates the filling requirements for the container, indicated in Kg/liter or with reference to paragraph 8.5.
Column 9:	Indicates any special requirements for the particular substance.

TABLE 1: LIST OF SUBSTANCES OF CLASS 2, NON-REFRIGERATED PRESSURE LIQUEFIED GASES TRANSPORTED IN TANK-CONTAINERS.

U.N. NUMBER	SUBSTANCE	DIVISION	SECONDARY RISK	MAXIMUM ALLOWABLE WORKING PRESSURE KG/CM^2 (BAR) SMALL, BARE, SUN-SHIELDED, INSULATED.	OPENINGS BELOW LIQUID LEVEL	PRESSURE RELIEF	FILLING KG/L	SPECIAL REQUIREMENTS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1005	ANHYDROUS AMMONIA, LIQUEFIED	2.3	8	29.6 29.2 22.4 20.1	ALLOWED	5.5.3	0.53	
1005	AMMONIA SOLUTION, WITH MORE THAN 50%	2.3	8	38.7 34.7	ALLOWED	5.5.3	SEE 8.5	
1009	AMMONIA	2.2		30.6 28.0	ALLOWED	NORMAL	1.13	
1010	BROMOTRIFLUORO-METHANE	2.1		7.6 7.1 7.1 7.1	ALLOWED	NORMAL	0.55	
1011	BUTADIENE, INHIBITED	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	0.51	
	BUTANE							

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1011	BUTANE MIXTURES	2.1		SEE MAWP DEFINITION IN THIS STANDARD	ALLOWED	NORMAL	SEE 8.5	
1012	BUTYLENE	2.13		8.2 7.1 7.1	ALLOWED	NORMAL	0.53	
1017	CHLORINE	2.3	5.1 8	7.1 19.4 17.3 15.3 13.8	NOT ALLOWED	5.5.3	1.25	THE CALCULATED WALL THICKNESS MUST BE INCREASED BY 3 MM. THIS MUST BE INSPECTED ULTRASONICALLY AT INTERVALS MIDWAY BETWEEN THE PERIODIC HYDRAULIC TESTS.
1018	CHLORODIFLUORO-METHANE	2.2		26.5 24.5 21.4 19.4	ALLOWED	NORMAL	1.03	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1020	CHLOROPENTA-FLUORETHANE	2.2		23.4 20.4 18.3 16.3	ALLOWED	NORMAL	1.06	
1021	CHLOROTETRA-FLUOROETHANE	2.2		10.5 10.0 8.1 7.1	ALLOWED	NORMAL	1.20	
1027	CYCLOPROPANE, LIQUEFIED	2.2		16.3 15.3 13.3 11.7	ALLOWED	NORMAL	1.15	
1028		2.2		26.5 24.5 21.4 19.4	ALLOWED	NORMAL	1.15	
1029	CHLORODIFLUORO-METHANE DICHLOROFLUORO-METHANE	2.2		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	1.23	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1030	1,1-DIFLUORO-ETHANE	2.1		16.3 14.3 12.6 11.2	ALLOWED	NORMAL	0.79	
1032	DIMETHYLAMINE, ANHYDROUS	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	0.59	
1033	DIMETHYL ETHER	2.1		15.8 14.1 12.2 10.8	ALLOWED	NORMAL	0.58	
1036	ETHYLAMINE	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	0.61	
1037	ETHYL CHLORIDE	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	0.80	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1040	ETHYLENE OXIDE WITH NITROGEN UP TO A TOTAL PRESSURE OF 1 MPa (10 bar) at 50EC	2.3	2.1	- - - 10.2	NOT ALLOWED	5.5.3	0.78	THIS SUBSTANCE MUST ONLY BE CARRIED IN CONTAINERS INSULATED BY A NITROGEN BLANKET
1041	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE	2.1		SEE MAWP DEFINITION IN THIS STANDARD	ALLOWED	NORMAL	SEE 8.5	
1055	WITH MORE THAN 9% BUT NOT MORE THAN 87%	2.1		8.3 7.1 7.1	ALLOWED	NORMAL	0.52	
1061	ETHYLENE OXIDE.	2.1		7.1	ALLOWED	NORMAL	0.58	
	ISOBUTYLENE			11.0 9.8 8.0 7.1				
	MONOMETHYLAMINE, ANHYDROUS							

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1062	METHYL BROMIDE	2.3		7.1 7.1 7.1 7.1	NOT ALLOWED	5.5.3	1.51	
1063	METHYL CHLORIDE	2.1		14.8 12.9 11.5 10.2	ALLOWED	NORMAL	0.81	
1064	METHYL MERCAPTAN	2.3	2.1	7.1 7.1 7.1 7.1	NOT ALLOWED	5.5.3	0.78	
1067	DINITROGEN TETROXIDE, LIQUEFIED	2.3	5.1 8	7.1 7.1 7.1 7.1	NOT ALLOWED	5.5.3	1.30	THE WALL THICKNESS SHOULD NOT BE LESS THAN 8 MM. TANKS MUST BE HYDRAULICALLY TESTED AND INTERNALLY INSPECTED AT INTERVALS NOT EXCEEDING 2.5 YEARS.

U.N. NUMBER	SUBSTANCE	DIVISION	SECONDARY RISK	MAXIMUM ALLOWABLE WORKING PRESSURE KG/CM2 (BAR) SMALL, BARE, SUN-SHIELDED, INSULATED.	OPENINGS BELOW LIQUID LEVEL	PRESSURE RELIEF	FILLING KG/L	SPECIAL REQUIREMENTS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1075	PETROLEUM GAS, LIQUEFIED	2.1		SEE MAWP DEFINITION IN THIS STANDARD	ALLOWED	NORMAL	SEE 8.5	
1077	PROPYLENE	2.1		28.5 25.0 22.4	ALLOWED	NORMAL	0.43	
1079	SULPHUR DIOXIDE, LIQUEFIED	2.3	8	20.4 11.8 10.5 8.7 7.7	NOT ALLOWED	5.5.3	1.23	THE CALCULATED WALL THICKNESS MUST BE INCREASED BY 3 MM. WALL THICKNESS MUST BE ULTRASONIC-ALY VERIFIED AT INTERVALS MIDWAY BETWEEN PERIODIC HYDRAULIC TESTS.
1082	TRIFLUOROCHLORO-ETHYLENE, INHIBITED	2.1		17.3 15.3 13.4 11.8	ALLOWED	NORMAL	1.13	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1083	TRIMETHYLAMINE, ANHYDROUS	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	0.56	
1085	VINYL BROMIDE, INHIBITED	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	1.37	
1086	VINYL CHLORIDE, INHIBITED	2.1		10.8 8.2 7.1	ALLOWED	NORMAL	0.81	
1087	OR STABILIZED	2.1		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	0.67	
1581	VINYL METHYL ETHER, INHIBITED	2.3		7.1 7.1 7.1 7.1	NOT ALLOWED	5.5.3	1.51	
	CHLORPICRIN AND METHYL BROMIDE MIXTURE							

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1582	CHLOROPICRIN AND METHYL CHLORIDE MIXTURE	2.3		15.5 13.3 11.8 10.3	NOT ALLOWED	5.5.3	0.81	
1858	HEXAFLUORO-PROPYLENE	2.2		19.6 17.2 15.4 13.4	ALLOWED	NORMAL	1.11	
1912	METHYL CHLORIDE AND METHYLENE CHLORIDE MIXTURES	2.1		15.5 13.3 11.8 10.3	ALLOWED	NORMAL	0.81	
1958	DICHLOROTETRA-FLUOROETHANE	2.2		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	1.30	
1965	HYDROCARBON GAS, LIQUEFIED, N.O.S. OR HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S.	2.1		SEE MAWP DEFINITION IN THIS STANDARD	ALLOWED	NORMAL	SEE 8.5	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1969	ISOBUTANE	2.1		8.7 7.6 7.1 7.1	ALLOWED	NORMAL	0.49	
1969	ISOBUTANE MIXTURE	2.1		SEE MAWP DEFINITION IN THIS STANDARD	ALLOWED	NORMAL	SEE 8.5	
1973	CHLORODIFLUOROMETHANE AND CHLOROPENTAFLUOROETHANE MIXTURE WITH FIXED BOILING POINT, WITH APPROX. 49% CHLORODIFLUOROMETHANE	2.2		28.8 25.8 23.2 20.7	ALLOWED	NORMAL	1.05	
1974	CHLORODIFLUORO-BROMOMETHANE	2.2		7.4 7.1 7.1 7.1	ALLOWED	NORMAL	1.61	
1976	OCTAFLUOROCYCLO-BUTANE	2.2		9.0 8.0 7.1 7.1	ALLOWED	NORMAL	1.34	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2602	DICHLORODI- FLUOROMETHANE AND DIFLUORO-ETHANE AZEOTROPIC MIXTURE WITH APPROX. 74%	2.2		20.4 18.3 16.3 14.8	ALLOWED	NORMAL	1.01	
3159	DICHLORODI- FLUOROMETHANE	2.2		18.0 16.0 14.1 12.3	ALLOWED	NORMAL	1.04	
3220	1,1,1,2-TETRA-FLUOROETHANE	2.2		35.1 31.4 28.0 25.0	ALLOWED	NORMAL	0.95	
3252	PENTAFLUORO-ETHANE DIFLUORO-METHANE	2.1		44.8 40.8 36.0 32.1	ALLOWED	NORMAL	0.78	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1978	PROPANE	2.1		22.9 20.6 18.3 16.8	ALLOWED	NORMAL	0.42	
1978	PROPANE MIXTURE	2.1		SEE MAWP DEFINITION IN THIS STANDARD	ALLOWED	NORMAL	SEE 8.5	
1983	1-CHLORO-2,2,2-TRIFLUORO- ETHANE	2.2		7.1 7.1 7.1 7.1	ALLOWED	NORMAL	1.18	
2424	OCTAFLUOROPROPANE	2.2		23.5 21.2 20.0	ALLOWED	NORMAL	1.07	
2517	1-CHLORO-1 (1-DIFLUOROETHANE	2.1		16.9 9.1 8.0 7.1 7.1	ALLOWED	NORMAL	0.99	

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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
3296	HEPTAFLUOROPROPANE	2.2		16.3 14.3 12.7 11.2	ALLOWED	NORMAL	1.20	
3297	ETHYLENE OXIDE AND CHLOROTETRAFLUOROETHANE MIXTURE, WITH NOT MORE THAN 8.8% ETHYLENE OXIDE	2.2		8.3 7.1 7.1 7.1	ALLOWED	NORMAL	1.16	
3298	ETHYLENE OXIDE AND PENTAFLUOROEHANE MIXTURE, WITH NOT MORE THAN 7.9% ETHYLENE OXIDE	2.2		26.4 23.9 21.3 19.0	ALLOWED	NORMAL	1.02	
3299	ETHYLENE OXIDE AND TETRAFLUOROETHANE MIXTURE, WITH NOT MORE THAN 5.6% ETHYLENE OXIDE	2.1		44.8 40.8 36.0 32.1	ALLOWED	NORMAL	0.78	

***** **N.O.S.: NOT OTHERWISE SPECIFIED.**

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